

Geological History Of Wasatch County

THE MYSTERY OF PREHISTORIC GEOLOGIC TIMES IS INTERPRETED BY A STUDY OF THE ROCKS, SEDIMENTARY DEPOSITS, FOSSIL REMAINS, ETC., FOUND IN THE HEBER CITY AND ADJACENT AREAS OF WASATCH COUNTY.

By RAY E. COLTON - Petroleum Geologist

Millions of years before the advent of man in what is today the geographical confines of Wasatch County and the area including and radiating from Heber City, the county seat and trading area for this part of Central Utah, Old Mother Nature began to write the record of her prehistoric creative and destructive genius.

Not on gavne tablet, or on written or printed page did the Old Dame leave this indelible record here for Man of today to decipher, but instead She has left the record in the form of sedimentary deposits, fossil remains of long vanished marine animal and plant life, together with remains of former mammalian life, all of which have been contemporaneous with the geologic periods, of which they were a part.

In imprints of tropical plant life found on Strawberry Pass, and in rocks of the sandstone type found in the Heber Mountain area east of Heber, we see the evidence which tells us of today that millions of years ago the first period of tropical climatic condition was in evidence in what is today the Wasatch County area of Central Utah.

In these, and in many other ways has Mother Nature left the record here for Man of today to decipher, and Man in the dual role of the petroleum geologist and the vertebrate paleontologist, has learned to interpret this record, with unerring accuracy.

Paleozoic Geologic Times

While earlier periods of the prehistoric past of this area are represented to slight extent among the rock systems of the Wasatch mountain ranges and its plateau to the east, yet as three (3) major periods of the geologic record are represented, these will be discussed as follows:

1. Paleozoic— This era is well represented in the Wasatch mountains which are incidently the major structural uplift of the Heber City and adjacent areas of Wasatch County. The general trend of the range is with the Salt Lake Basic Meridian. After leaving Heber City on U. S. Highway No. 189 going toward Charleston, on looking back one will discern that the range is a bold high ridge, and its western face is an escarpment. Here in this escarpment many rocks of the Paleozoic period are represented in the forms of schists, granitic

intrusions, etc. The range appears to spring up abruptly from the canyon and valleys. Starting at a point near Strawberry Pass and thence through Heber northward, various elevations are in evidence, yet actual measurements taken during field geologic research work by the writer and other geologists, reveal that the average elevation above sea level is 9060 feet, thus being approximately 4,000 feet above Heber City, which has an elevation above sea level of 5560 feet. Of course, there are outstanding uplifts in this area such as Heber Mountain, elevation 10,275 ft. and Mt. Timpanogas to the west. These however, are such as were erected above the main Wasatch Range during periods of land mass and other adjustments.

The structure of the local range in respect to the Heber City and Wasatch County area is extremely complex. The rocks comprising the major portion of the range here locally are of Paleozoic, Triassic and Jurassic geological periods. Rocks of previous geologic records such as Archaean and Algonkian, are also in evidence. There are large masses of granite present and two (2) notable unconformities have been observed during a study of the range, and these appear among the sedimentary deposits, but as far as can be determined up until this spring the deposition of the strata appears to have been continuous from the Carboniferous period of the Paleozoic era through successive geologic periods to the Jurassic, representing the middle period of the Mesozoic era, the latter following the Paleozoic in geologic sequence.

2. Mesozoic— The Mesozoic period which was composed of the Triassic, Jurassic and Cretaceous sub periods, each having contemporaneous forms of animal, reptilian and plant life, is represented by the Jurassic rock system in the local Wasatch Uplift as follows:

The deposition of rocks of the Jurassic system followed by a distrophic revolution. The mountains were faulted and folded giving them the grotesque shapes which they possess today as major physical properties. This work on the part of Old Mother Nature was on a large scale and among the faults thus created were extensive overthrusts. The mountains and valleys created by

these dislocations were apparently not coincident with the present mountains and valleys which one sees here today. The portion of the uplift which was associated with the intrusions is now marked by lofty summits (Heber Mt.)

The topography thus created by the dislocation was so far reduced by erosion during the Cretaceous or closing period of the Mesozoic era, now being discussed here, that a transgression of the sea spreads of sandstones of the Dakota series shows over worn edges of previously deposited rocks of the Upper Carboniferous, the Jurassic and Triassic systems. After the retreat of the sea, as a study of the range here shows, there appeared other crustal changes, and then a long period of relative quiet in which the general movement of the debris was from west to east and a broad area to the east of Strawberry Pass, received terrestrial and lacustrine deposits.

Note: This discussion will be continued in the next article of this series appearing as an exclusive feature in the Wave by Ray E. Colton.

Geological History Of Wasatch County

DID THE LIFE OF THE SEA ONCE INHABITING WHAT WAS THE WATERS OF LAKE BONNEVILLE, LEAVE PETROLEUM "SOURCE" BEDS BENEATH THE WASATCH COUNTY AREA OF CENTRAL UTAH?

By RAY E. COLTON - Petroleum Geologist

with organic life, both of shell or "mollusca" types and plant life such as corals, algae, diatoms, kelp, seaweed, etc., which after death provided an abundance of organic material. Under proper conditions of burial and decay, bacteria in all probability acted upon this organic matter and formed various hydrocarbons which ultimately yielded the complex mixture which we of today know as petroleum or rock oil. Sedimentary rocks such as are represented in some of the composite of the Wasatch Mountains, seldom rested during geologic time, without being subjected to great stress. Compression and tension resulting from tectonic forces engaged in mountain building fractured and bent the rocks of

now into the spring of 1948, petroleum geologists, including the writer, made extensive studies of the local structural arrangement here in Heber City, Kamas, Center Creek, Charleston and adjacent areas, for the purpose of ascertaining, if potential deposits strata into more porous and per-vious strata. Water was often imprisoned in the sandstones at the time of deposition. As the petroleum trickled into a permeable sand, it did not mix with the water, but being lighter, rose to the upper part of the fluid level in the sand and then in all probability migrated horizontally through the sand until trapped as follows:

The results of these field studies, on which the writer in this article will reveal some, have been very encouraging, and there is a strong possibility, that the marine animal and plant life of such long vanished inland sea, such as Lake Bonneville left remains from which, if the organic theory of oil's evolution is correct, could have been created, petroleum "source" beds in the form of muds, clays, silicates and carbonates. In this connection it is well to point out to the reader, that geologic conditions under which oil may form and accumulate, appear to be best exemplified in rocks which are sedimentary in origin. Of the sedimentary rocks, many types of which appear here in the Heber and other areas of Wasatch County and adjoining Utah and Summit counties, the petroleum geologist finds that those which were deposited under the marine (sea) conditions (Lake Bonneville) are the most favorable for the occurrence of petroleum. Marine (sea) bodies of water such as long vanished Lake Bonneville usually form

1. By an anticlinal structure (upward arch of the beds of the earth's surface.)
2. By change in porosity.
3. By pinching out of the sand.
4. By any feature which prevented further migration of the fluids. Surface and sub surface conditions may indicate to the competent field petroleum geologist, the location of such traps. It is in such places here in Wasatch County that the geologist will eventually recommend the drilling of test well drilling sites for the recovery of commercial amounts of oil believed to underlie areas of Wasatch County. Note: This discussion will be continued in the next article of this series.

—Ray E. Colton

Geological History Of Wasatch County

THE PRESENT FEATURES OF THE LOCAL WASATCH MOUNTAIN RANGE DATE FROM ANOTHER DIASTROPHIC PERIOD OF CENTRAL UTAH'S PREHISTORIC GEOLOGIC PAST!

By RAY E. COLTON - Petroleum Geologist

The present physical features of the local Wasatch and satellite mountain ranges in the Heber City and adjacent areas of Wasatch County are due in the main to another period of diastrophism which was of post-Eocene age. Now we come to the third major geologic period represented here.

3. Cenozoic— This period which was responsible for the present features of the mountains of this area of Central Utah was composed of two epochs, as follows:

- 1- Tertiary or "age of Mammals"
- 2- Quaternary or "age of Man".

Various sub periods, as will be explained in other articles of this series, were parts of each epoch. Therefor in referring to the post-Eocene as responsible for the present features of the Wasatch range here locally, we mean that period of the Tertiary Epoch which opened the era. However the date of the beginning of the present relief features cannot be accurately determined at present. A small fraction of the present sedimentary deposits are of post-Pleistocene, meaning the second sub-period of the Quaternary Epoch, or second period of the major Cenozoic era. There appears after a study of the rocks here locally that there was great progress made before an epoch of Pliocene time when lake beds (Bonneville) were deposited here in the Heber Valley and on the east flank of the range across Strawberry Pass. One crustal change of the Tertiary Epoch was of a broad character and resulted in a general reversal of the slopes controlling drainage. The field of Eocene deposition of strata became an upland and a western district which had been a field of Eocene degradation, became a lowland.

Lake Bonneville

One of the largest of the prehistoric inland lakes or "seas" covering what is today Central Utah during past periods of the geologic record was long vanished Lake Bonneville whose shorelines are still visible here in the Heber area, and in Provo Canyon. Lake Bonneville was 346 miles in length, 145 miles in width, and 1,050 feet deep in the center. The lake covered during its greatest period of inundation about 25,000 years ago, one third of the present state of Utah.

Lake Bonneville rose as the evidence shows here in the Wasatch Mountains until it finally found an outlet to the north in present day Southern Idaho via the Portneuf into the Snake River, and having few island obstructions to the winds, its waves cut very conspicuous shorelines, still plainly visible on the sides of Utah-Idaho

Two Shorelines

There are two (2) conspicuous shorelines because the lake stood at its highest point for many years and formed the so-called Lake Bonneville shoreline, and later, after the outlet had cut down the rock bottom, it again remained at that level for a long period of time before it commenced to dry up and at this latter level it formed the so-called Provo shoreline. Below the Provo shoreline there are many minor shorelines some of which are visible going south on U. S. highway 189 past the Deer Creek reservoir and in Round Valley.

These minor shorelines show that in its decline Lake Bonneville stood stationary for long periods of geologic time, but there are no shorelines found between the Bonneville and the Provo shorelines, thus revealing that once started, the great lake drained off very rapidly.

Note: Prehistoric marine animal and plant life once inhabiting Lake Bonneville could have left source beds for petroleum and rock oil. This will be discussed in the next article of this series.

—Ray E. Colton

Wasatch County Offers Rare Geologic Study

by Ray E. Colton
Petroleum Geologist

Leaving U. S. highway number 40 three miles east of the summit of Strawberry, one turns off the highway onto a gravel and improved road which bears signs Carter Oil Company well. Following these signs for a distance of fifteen miles passing the Madson Fish Camp and along the shores of Strawberry Reservoir, we reach the drilling site of the Carter Oil Company's well H. C. Duhrkop number one location sw, se of section 33, township 4-south, range 11-west Wasatch County. Enroute one has seen one of the most marvelous of geologic strata, rocks with

hundreds of millions of years in antiquity, presenting themselves as mute evidence of Old Mother Nature's creative ability of prehistoric Utah geologic time. Going up the pass from Heber City to the right and left of highway number 40 the Wasatch Mountains present themselves as a bold-high ridge, and it's western face is termed geologically as an "escarpment". Here in this escarpment, many rocks of Paleozoic geologic time are represented in the form of schists, granite intrusions etc. The range appears to spring up abruptly from Daniel's Canyon. The structure of the local Wasatch Mountains insofar as the Heber City-Daniel's canyon areas of Wasatch County is concerned, is extremely complex. The rocks composing the major portion of the range and those in the immediate vicinity of the Carter Oil Com-

pany drilling site, about 36 miles east and southeast from Heber City, are of Paleozoic, Triassic and Jurassic geologic periods, thus representing two (2) major eras of the geologic time chart.

Rocks of previous records such as the Archean and Algonkian, are also in evidence along the route. There are large masses of granite present to the east of Heber City and two (2) notable unconformities in the strata, are in evidence.

The Mesozoic period which contained three sub divisions are as follows:

1- Triassic 2- Jurassic 3- Cretaceous is represented in the Jurassic rock system of the local Wasatch Mountains.

The deposition of rocks of the Jurassic or middle period of Mesozoic time was apparently followed by a diastrophic revolution, and the mountains at this time were faulted and folded, giving them the spectacular features which they possess today. This work on the part of Old Mother Nature was on a large scale and among the faults thus created were large overthrusts, with strata of a later geologic period, resting upon those of a previous period.

EROSION REDUCED PREVIOUS DEPOSITIONS

At the time of deposition many types of strata were created among them limestone, sandstone, shales etc., and this topography was so far reduced by erosion during the Cretaceous or closing period of Mesozoic geologic time, that a transgression of the sea spread sandstone of the Dakota series of strata over worn edges of previously deposited rocks of the Upper Carboniferous, the Jurassic and Triassic systems.

After the retreat of the sea as a study locally reveals especially in the Strawberry Reservoir area of Wasatch County, nearly where Carter Oil Company is now drilling, there appeared other crustal changes, and then a long period of relative quiet in which the general movement of the debris was from west to east, and a broad area to the east of present Strawberry Pass received terrestrial and lacustrine deposits.

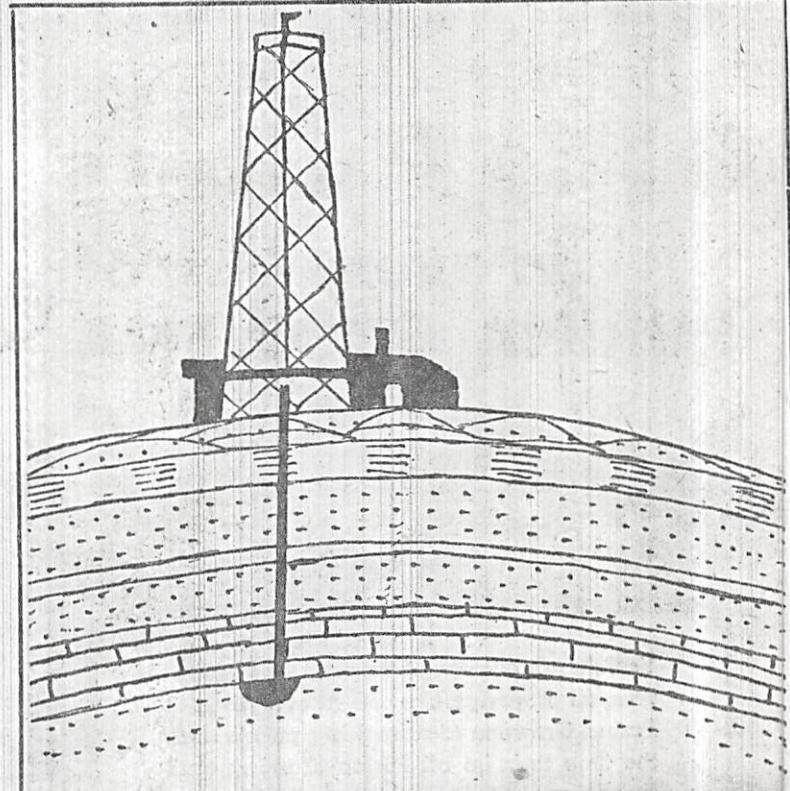
In the area around Strawberry Reservoir where the H. C. DUhrkop well is being drilled, many rocks having vast geologic antiquity, are to be seen in the stratigraphic sequence. Sandstones, some petrified wood fragments appear in the area bounded by township 4-south, range 11-west and especially in section 33 where drilling is in progress for the ultimate recovery of petroleum and natural gas in commercial amounts by the Carter Oil Company.

NOTE: Rotary drilling equipment now being used to drill the well will be discussed in another article of this series appearing as an exclusive feature in the Wasatch Wave.

Geological History Of Wasatch County

FURTHER ELIMINATION WOULD BE EXPLOYED IN NARROWING SEARCH FOR OIL AND GAS IN WASATCH COUNTY TO MORE RESTRICTED LIMITS!

By RAY E. COLTON - Petroleum Geologist



RECOVERY OF OIL FROM AN ANTICLINAL FOLD.

Having recognized the favorable and possible petroleum and natural gas bearing areas of Wasatch County, there are additional criteria which the petroleum geologist may use to narrow the search to more restricted limits. These are:

1. The existence of surface indications in the area under study.
2. The sedimentary origin of the rocks.
3. The similarity in age of strata with those prevailing in some regional oil field.
4. The existence of possible source origin, and this will be determined by amount of fossil remains of marine animal and marine plant life found in the area under study.
5. The existence of porous beds or reservoirs in which oil may occur and which may be held in commercial amounts.
6. The existence of sufficient caprock above the potential oil reservoir to prevent the escape of the oil and gas to the surface.
7. The metamorphism of the strata must be found to be sufficiently slight so that oil and gas previously deposited during periods of water inundation, was not driven away by ensuing periods of volcanic eruptive processes.
8. The existence of geologic structure in the area under study suitable for the concentration of oil and gas in commercial amounts.
9. The existence of hydrostatic conditions favorable to the accumulation of oil in pools, must be found.

If the majority of the factors discussed in this and the previous article are represented for a prospective area here in Wasatch County an oil or gas field may be predicted. Taking the

factors one by one and applying them to the possible and favorable areas of this part of Central Utah (Salt Lake-Uinta Basic Meridians) we find that there may be strong possibilities of oil and gas recovery here under proper drilling operations or rotary drilling tools.

Surface Indications of Petroleum

The occurrence of petroleum seepages in the form of filaments, etc., usually appearing after heavy seasonal rains along creeks and rivers is easily recognized and may be significant as a presence of petroleum in a given district. Seepages may also occur in wells drilled on ranches for water, in pools and also as a seep of asphalt.

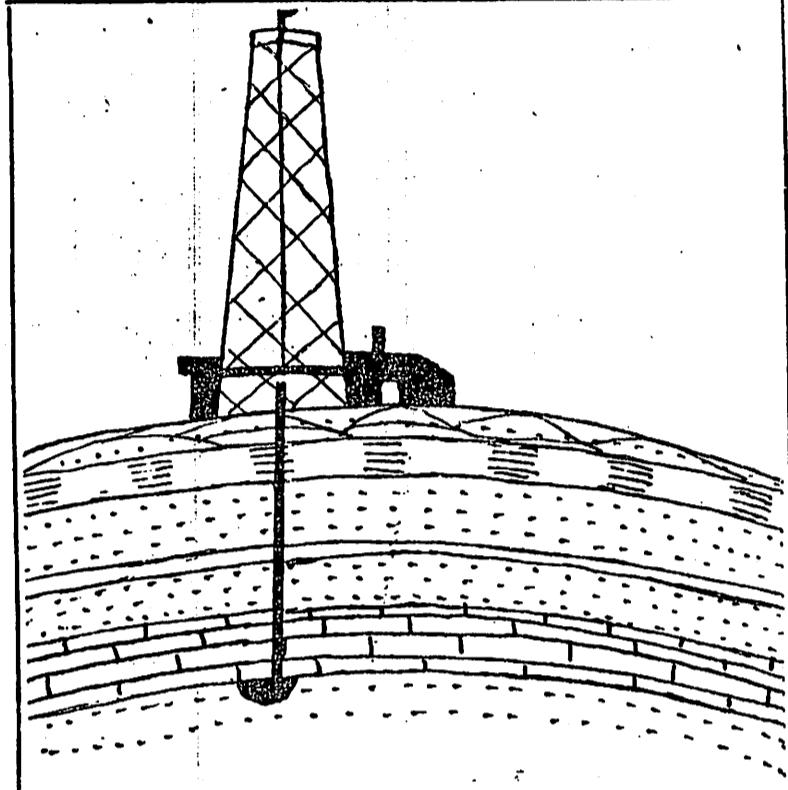
There is no reason to assume that because oil has never been recovered here in Wasatch County that no oil exists. The public likes to visualize an era producing oil as the plains of Oklahoma and Kansas or the Texas Panhandle. But remember these areas did not produce oil before they were drilled. The fact that mountains are in predominance here in the Heber City and other areas of Wasatch County, has no bearing on the deposition of petroleum during past periods of Central Utah's prehistoric past.

As explained in article number 1 of this series the range which you see today is not the original range, and as seas came, and seas receded, they no doubt deposited their organisms of life in the prevailing strata of the time. After the advent of Lake Bonneville, more marine animal and marine plant life was deposited, and it is these depositions which offer the best chances for ultimate recovery in commercial amounts of petroleum.

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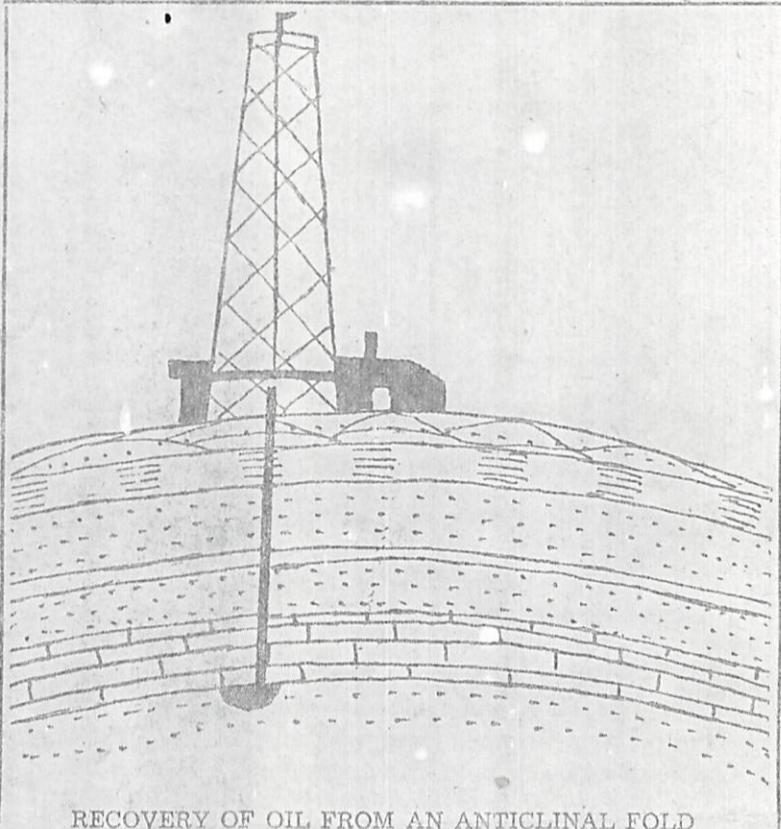
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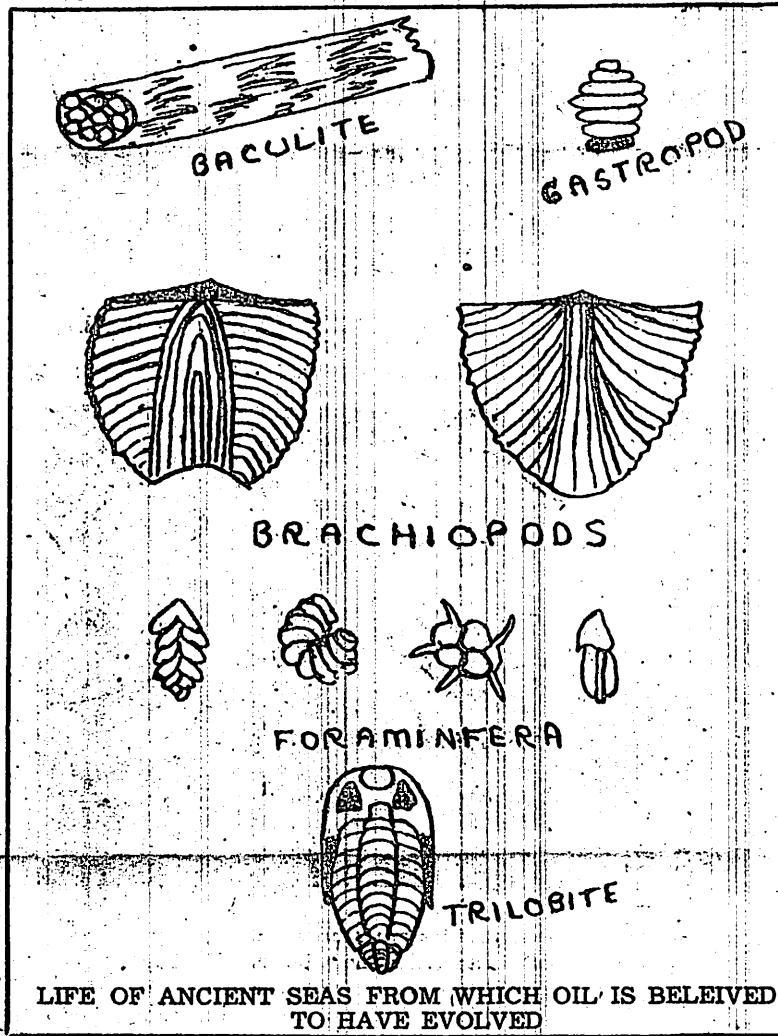
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MANY FORMS OF LIFE INHABITATED THIS AREA DURING THE THREE MAJOR PERIODS REPRESENTED BY THE ROCKS IN WASATCH COUNTY. PALEOZOIC TIMES WITNESSED WATER INUNDATION.



As stated in article number 1 of this series three major periods of the geological record are represented in the rocks, fossil remains and sedimentary deposits of the Wasatch Mountains. These are as follows:

1- Paleozoic, composed of the following sub periods:

(a) Cambrian, forms of life shelled animals of the sea, Trilobites, Brachiopods predominating in the rule of the sea then covering this area of present day Central Utah.

(b) Ordovician, forms of life progress among the mollusks "shelled animals, Corals and Ery-

(c) Silurian, forms of life armored fishes, first land animals, scorpions.

(d) Devonian, forms of life shark-like fishes, land floras established.

(e) Carboniferous, forms of life spore-bearing plants along the shoreline of the sea.

(f) Permian, forms of amphibians and reptiles of the land and sea.

Note: The end of the Paleozoic era marked the beginning of the Mesozoic era which followed it in geologic sequence, and new forms of life became evident.

2- Mesozoic era, composed of the following sub periods:

(a) Triassic, forms of life dinosaurs "terrible lizards", few small mammals of low order.

(b) Jurassic, forms of live birds and flying reptiles, cycads (plants) flowering plants.

(c) Cretaceous, forms of life principally of large seas and lakes such as bony fishes (Pleisosaur, Mosasaur and Ichthysaur). Great reptiles dying off.

Note: The end of the Mesozoic era witnessed the arrival of the Cenozoic era which followed it in geologic sequence. This will be discussed shortly, however, before we leave the Mesozoic let us discuss its reptiles.

The era was known as the "age of reptiles" owing to the fact that giant reptiles termed Dinosaurs, "terrible lizards" were the ruling class of the land areas bordering the lakes and seas. The dinosaurs were cold-blooded, air-breathing reptiles ranging in size from three feet up to the huge plant eating Brontosaurus or "thunder lizard" which weighed about 90 tons and was about 85 feet in length. Some of the dinosaurs were smooth-skinned, while others such as Tyrannosaurus Rex "king of the tyrant lizards" was armored and covered with spikes. Some of the dinosaurs had hundreds of teeth, while others of the species were toothless. Some were bipedal in gait, using their hind legs for purpose of locomotion, others walked on all four legs. Yet in view of the fact determined by a study of their skeletal remains found principally north of Vernal-Jensen in Uinta County, northeastern Utah, that all of them possessed certain anatomical characteristics in common, scientists have placed these giant reptiles once common to northern Utah under one general category, dinosaurs.

They became totally extinct at the close of the Cretaceous period of the Mesozoic era when a cold and dark climate caused the eradication of the lush tropical vegetation upon which the plant eaters subsisted. They began to die off. The giant flesh eaters having more to eat soon followed the plant eaters into oblivion.

Since this time about 75,000,000 years ago there have been no return of these forms of reptilian life. However, the present day Kimodo lizards of Formosa, the Monitors of French Indo-China, the Gila Monster of Arizona, are believed to be the re-incarnation of these giant reptiles of prehistoric times.

Note: The Cenozoic era and its effect on what is today Wasatch County will be discussed in the next article of this series.

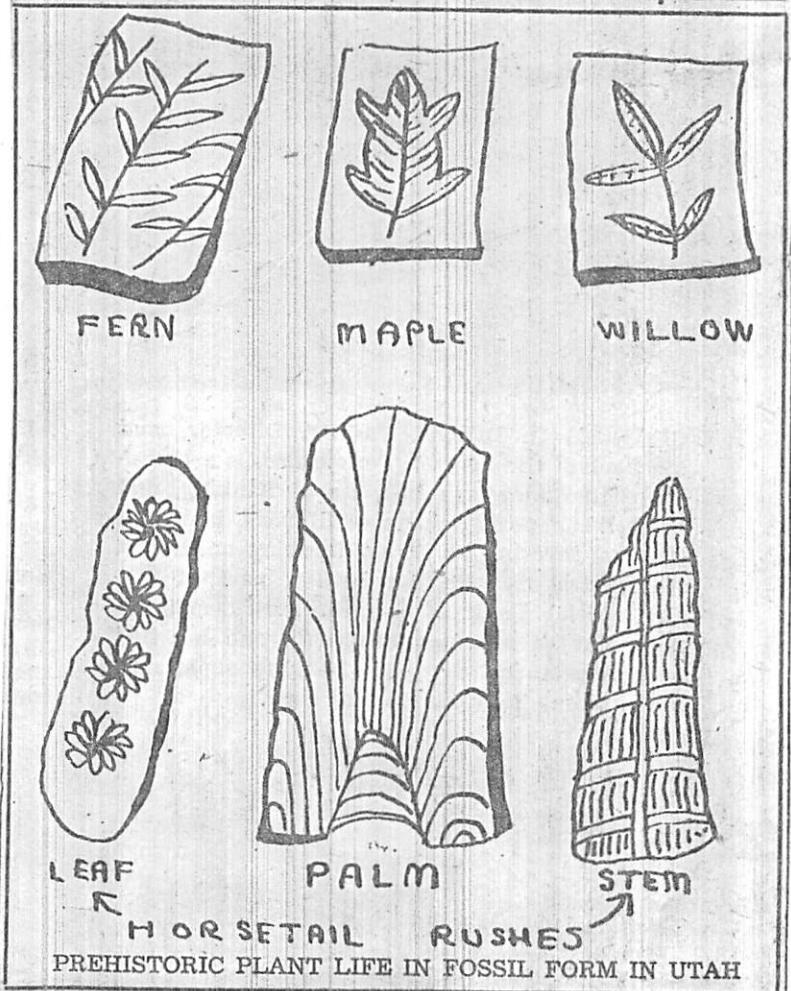
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THE CENOZOIC ERA WITH ITS VARIOUS SUB GEOLOGIC PERIODS IS WELL REPRESENTED IN THE HEBER CITY AREA. MANY FORMS OF LAND MAMMALS WERE HERE.

During studies made here in Wasatch County, part of which were devoted to prehistoric Lake Bonneville's alluvium deposits, it is interesting to note that the Cenozoic era which followed the Mesozoic era in sequence had a striking feature of development of life. This is exhibited in the great progress and expansion of the mammalian race. The division of the era into periods was based largely on a study of fossil mollusks. Early geologists of Utah grouped the rocks of the era into three grand divisions of geologic time, applying the names Primary, Secondary and Tertiary. To these were added afterwards the name Quarternary, which applied to the youngest formations of the earth. Only two of the original terms remain in use today; it is a frequent practice to refer to the combined Eocene, Oligocene, Miocene and Pliocene periods as the Tertiary Epoch of Cenozoic geologic time.

The geology of some remote feature may be clearer with regard to the full significance of this sub division of the "age of mammals" into two parts. It may be that a great era was concluded at the end of Pliocene time as others have been concluded by the usual earth disturbances and climatic changes and by the decline of animals once prominent in the faunas of the world. The oldest of the Eocene



rocks here in the canyons and in the Wasatch Mountain range shows a great variety of mammals and a strange assortment of forms far in advance of the Mesozoic record. Ancestries and successive stages of development have been partly worked out by the University of Utah and other seats of learning in the intermountain area, though details have been better preserved for some of the groups than for others.

PREDOMINATING FORMS OF LIFE

Partial skeleton remains found during the past year in this area of Central Utah reveal that the following forms of land mammal life were here during the period of the geologic record applicable to Cenozoic times, and of which they are now a historical part:

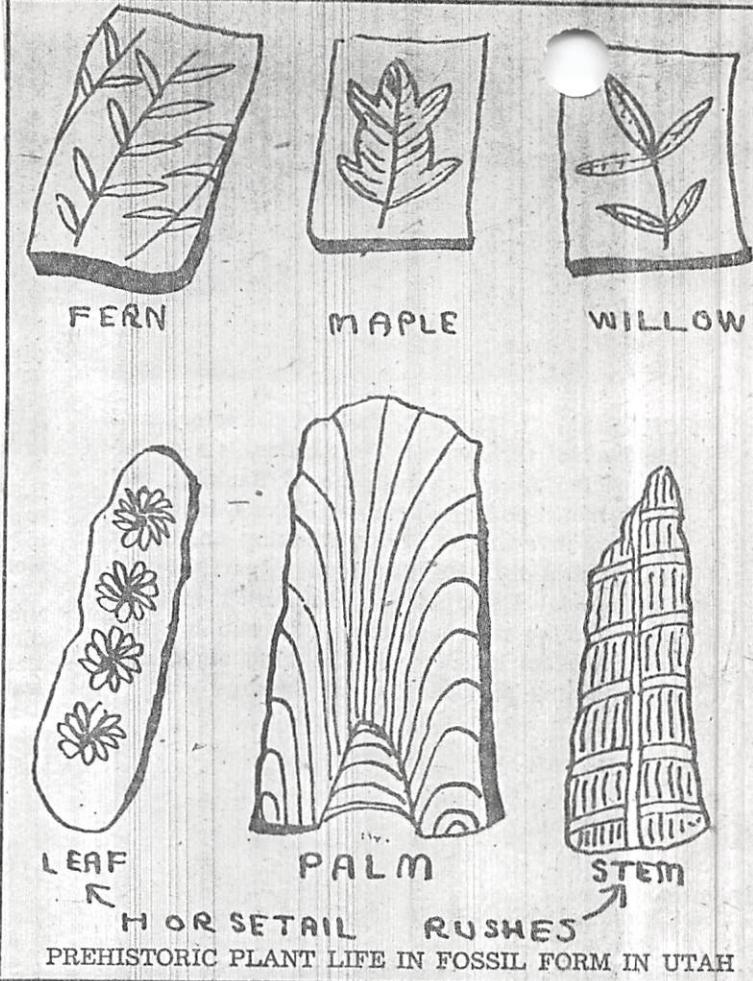
Tertiary Epoch: Sub Period:

- 1 - Eocene, forms of life, three toed pygmy horse, sabre-tooth tiger.
- 2 - Oligocene, forms of life, wooly rhinoceros, camels, sloths, etc.
- 3 - Miocene, forms of life, grasses and grazing animals.
- 4 - Pliocene, horses modernized.

Quarternary Epoch: Sub Period:

1. Pleistocene, forms of life mammoths and mastodons.
2. Recent, Man and his culture.

9



PREHISTORIC PLANT LIFE IN FOSSIL FORM IN UTAH

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- 1 - Eocene, forms of life, three toed pygmy horse, sabre-tooth tiger.
- 2 - Oligocene, forms of life, wooly rhinoceros, camels, sloths, etc.
- 3 - Miocene, forms of life, grasses and grazing animals.
- 4 - Pliocene, horses modernized.

Quaternary Epoch: Sub Period:

- 1 - Pleistocene, forms of life mammoths and mastodons.
- 2 - Recent, Man and his culture.

The Time Chart

The whole of geologic time has been divided and subdivided according to varying practices. The development of life is perhaps the one outstanding feature of the time divisions, but for the most part, the changes in floras and faunas have been gradual rather than abrupt and this makes it very difficult to draw sharp lines or to visualize beginnings and endings of the various stages of development. The movements of parts of the earth's crust especially here in the Wasatch uplift area of Central Utah and Wasatch County have been exceptionally pronounced at certain times, often culminating in the production of mountain systems, and because of the extreme changes they introduce, are termed revolutions. The major divisions of prehistoric geologic time have been established, at least in part, by such revolutions; crustal, climatic or other disturbances, on a smaller scale and recurring with greater frequency, may be regarded as establishing boundaries for the minor divisions. Hence we have five great eras of geologic time, and these are again divided into periods. The period of time in which we of today live is known as the Recent. It began at the close of the Ice Age or Pleistocene period about 15,000 years or less ago and represents so little of the earth's history since the beginning of life that a gigantic chart would have to be constructed and used in order to show the rest of the periods in comparison. Rocks of every period except the Silurian are known to have been deposited at one time or another here in Utah since "time's dawn". It often happens that a formation is not where we expect to find it, this being due to several possible factors.

- 1 - The sediments may not have been deposited there.
- 2 - There may have been removed by erosion.

Where the local structure in a case of searches for oil the structure has been disturbed by folding and faulting, a multitude of complications is at once introduced. The expected sequence is sometimes inverted and repeated through a series of folds. Formations may also be removed several miles by faulting. Both thickness and character of sediments may vary considerably within a formation. In some regions the geology is very simple, in others extremely difficult to interpret. The

Geological History Of Wasatch County

By RAY E. COLTON - Petroleum Geologist

THE PREHISTORIC RECORD OF WASATCH COUNTY IS DETERMINED BY A STUDY OF THE ROCKS AND FOSSILS.

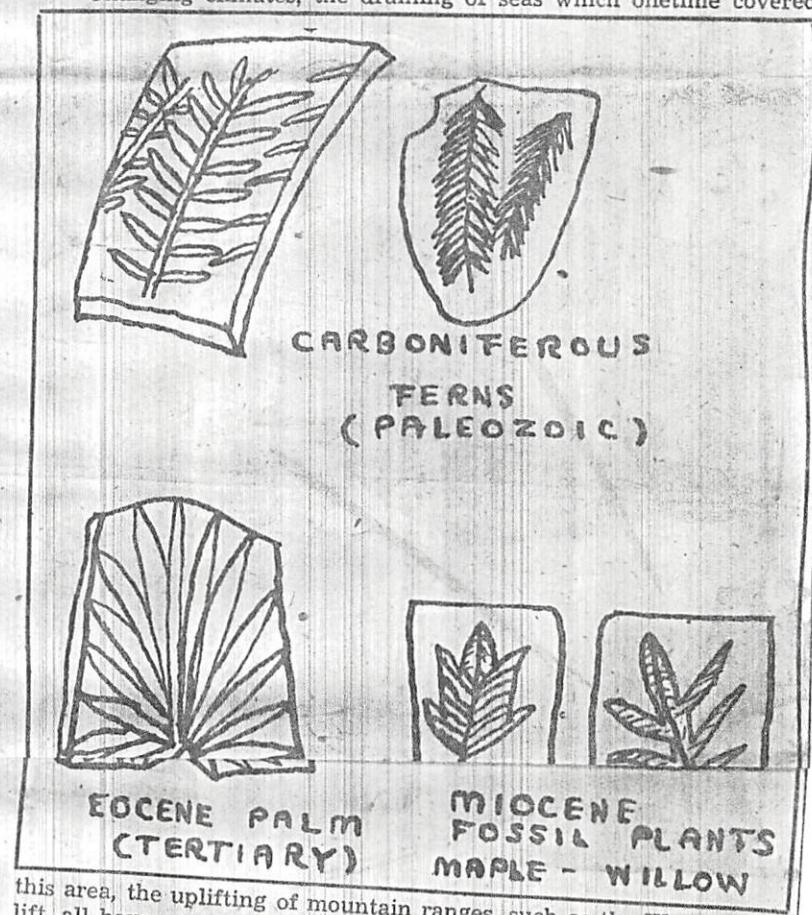
All that is now known of the extinction of plants and animals which have inhabited what is today Wasatch County and the Heber City area, has been obtained from a study of the rocks, fossil remains, etc., found here.

The few possible exceptions to this rule, in which animal and plant remains have been preserved by freezing or drying, are so unusual as to be hardly worthy of mention.

The explanation of this is that plant and animal tissues quickly decay under ordinary conditions, when life ceases. Unless protective agencies have been active, even the heavier bones of animals and the former giant reptiles, will crumble and cease to exist. It should be understood first that a fossil as discussed here is some record commonly preserved in a rock, of a kind of plant or animal which no longer exists as a common habitat of the area where the fossil is found. This at least is the ordinary sense of the word and more elaborate definitions are of small service to the layman. It may be necessary to add, however, that all things which have lived at any time are herein regarded as either plants or animals.

Nature's manner of producing rocks and fossils remains a mystery to many of us today who are so wrapped up with the importance of finding names for things and materials that we frequently neglect the consideration of sources and histories. Everyone knows a rock when he or she sees it in a large mass, but when he or she looks at sand, mud, dust or soil one seldom thinks of it as related in any manner to the rocks. The difference is merely a matter of size, but our use of words makes it appear unreasonable to speak of the finer particles of rock. The rocks themselves must explain the many things which have happened during the course of millions of years of geologic time, and this they do remarkably well when carefully studied for the various factors which were involved in the histories leave characteristic marks.

Changing climates, the draining of seas which onetime covered



this area, the uplifting of mountain ranges, such as the Wasatch Uplift, all have ways of contributing to the prehistoric geologic record. These are as convincing and reliable as any record ever written by Man. Piece by piece the story has been patched together, through the efforts of thousands of geologists and paleontologists. Parts of the narrative remain buried at inaccessible depths, and whole chapters have no doubt been destroyed by the same forces that have composed this tremendous record of prehistoric life.

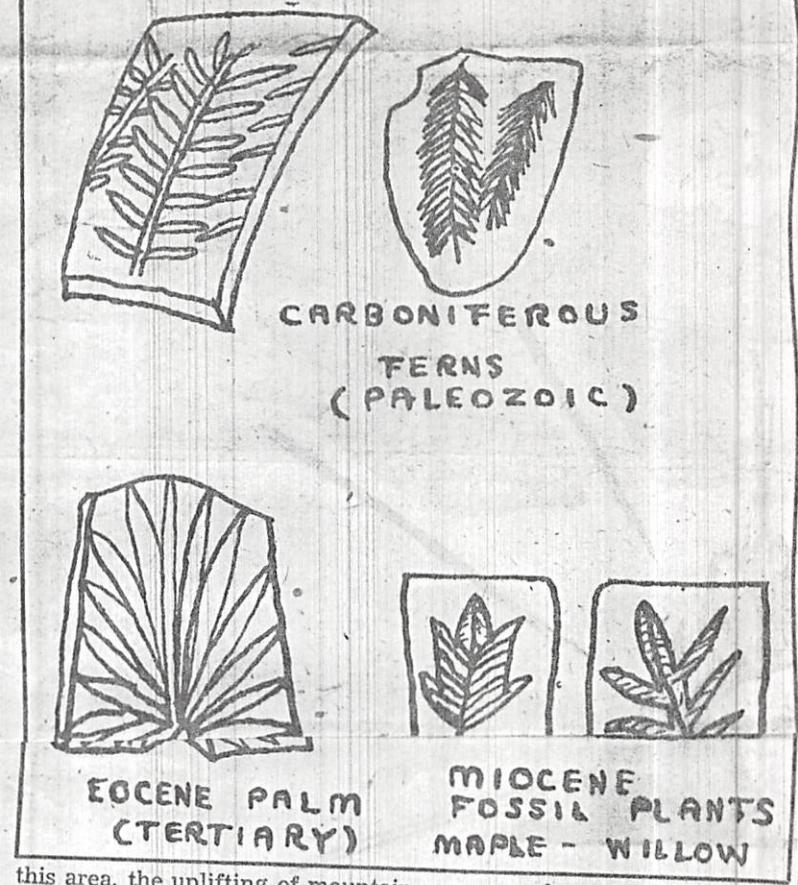
Varieties of Fossils
The illustration accompanying this article shows some representative types of plant fossils, some tropical, others semi-tropical, and many of these have been found in Central and Eastern Utah.

Fossils are classified as follows:

1 - Impressions of animals and plants, or parts of these, are frequently left in soft sand or mud, which later becomes converted into more durable rock. This type of fossil is represented by animal footprints and the imprints of leaves, flowers, insects, and like objects which may be mingled with the finely ground materials of the same sedimentary rocks.

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2 - Parts of plants and animals may be gradually replaced by mineral matter with little or no change from the original form and texture. Fossils of this class are said to be petrified or turned to stone. They are also termed as replacements. The fleshy parts of the animals did not petrify.

3 - Many animals among the invertebrates of prehistoric geological times used mineral substances for protective or supporting structures. Small plants of various sizes evidently followed a similar practice. These fossils being produced in this field, and all that is required for a shell to become a fossil is the extinction of the animal which produced it. Fossils of this type are extremely abundant in Wasatch County and along ancient lake and sea shorelines of this area of Central Utah.

4 - Preservative substances other than those which produce common rocks may be mentioned among fossil-making possibilities. Bones are known to have been preserved in asphalt, and insects in resin, but such cases are few in comparison with the other methods.

5 - Coal beds often produce fossils of an unusual type. In the formation of coal plant material gradually lost some of its more perishable substances but retained the carbon, which possessed better last qualities down through the ages and slowly accumulated to produce the seams and beds of coal that are mined today. In the early stages of the process it appears after a study of the coal veins the original vegetation underwent little change in appearance but eventually all of its character was lost. Many fossil leaves are found as thin layers of carbon, bedded in the clays which are commonly associated with coal deposits.

The smaller fishes of prehistoric geologic time such as inhabited long vanished Lake Bonneville, provided much better material for fossil making. While the fish was being flattened by the weight of surrounding sediments, scales, fins and soft bones retained their positions and provided the necessary resistance to leave an impression of the body form when the flesh was gone.

The larger and more spectacular fossils such as dinosaur, mastodon and others, are nearly always of the replacement type. Replacement of plant and animal substances by mineral matter was a slow process and in younger fossils the change was rarely completed, some of the original material being present in a partly altered condition or not modified at all.

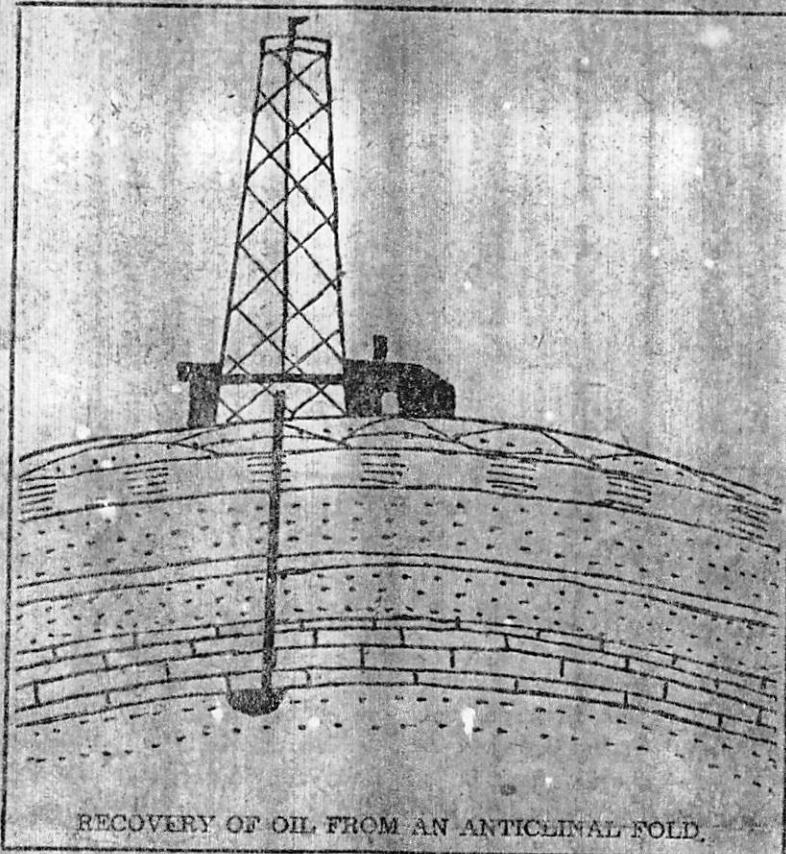
Besides converting bony or wooded objects into rock substance, mineral replacements probably assisted in the production and preservation of fossils in another manner.

Yes, the rocks and fossil remains found in Wasatch Co.

Geological History Of Wasatch County

FURTHER ELIMINATION WOULD BE EMPLOYED IN NARROWING SEARCH FOR OIL AND GAS IN WASATCH COUNTY TO MORE RESTRICTED LIMITS!

By RAY E. COLTON, Petroleum Geologist



RECOVERY OF OIL FROM AN ANTICLINAL FOLD.

Having recognized the favorable and possible petroleum and natural gas bearing areas of Wasatch County, there are additional criteria which the petroleum geologist may use to narrow the search to more restricted limits. These are:

1. The existence of surface indications in the area under study.
2. The sedimentary origin of the rocks.
3. The similarity in age of strata with those prevailing in some regional oil field.
4. The existence of possible source origin, and this will be determined by amount of fossil remains of marine animal and marine plant life found in the area under study.
5. The existence of porous beds or reservoirs in which oil may occur and which may be held in commercial amounts.
6. The existence of sufficient caprock above the potential oil reservoir to prevent the escape of the oil and gas to the surface.
7. The metamorphism of the strata must be found to be sufficiently slight so that oil and gas previously deposited during periods of water inundation, was not driven away by ensuing periods of volcanic eruptive processes.
8. The existence of geologic structure in the area under study suitable for the concentration of oil and gas in commercial amounts.
9. The existence of hydrostatic conditions favorable to the accumulation of oil in pools, must be found.

If the majority of the factors discussed in this and the previous article are represented for a prospective area here in Wasatch County an oil or gas field may be safely predicted. Taking the

factors one by one and applying them to the possible and favorable areas of this part of Central Utah (Salt Lake-Uinta Basic Meridians) we find that there may be strong possibilities of oil and gas recovery here under proper drilling operations or rotary drilling tools.

Surface Indications of Petroleum

The occurrence of petroleum seepages in the form of filaments, etc., usually appearing after heavy seasonal rains along creeks and rivers is easily recognized and may be significant as a presence of petroleum in a given district. Seepages may also occur in wells drilled on ranches for water, in pools and also as a seep of asphalt.

There is no reason to assume that because oil has never been recovered here in Wasatch County that no oil exists. The public likes to visualize an era producing oil as the plains of Oklahoma and Kansas or the Texas Panhandle. But remember these areas did not produce oil before they were drilled. The fact that mountains are in predominance here in the Heber City and other areas of Wasatch County, has no bearing on the deposition of petroleum during past periods of Central Utah's prehistoric past.

As explained in article number 1 of this series the range which you see today is not the original range, and as seas came, and seas receded, they no doubt deposited their organisms of life in the prevailing strata of the time. After the advent of Lake Bonneville, more marine animal and marine plant life was deposited, and it is these depositions which offer the best chances for ultimate recovery in commercial amounts of petroleum.

6/6/64

City, Wednesday, December 11, 1957

Wasatch Is Summer Home Area

*Recreational Spots, Hot Springs, Scenic Drives And Mountain Climate
Make Wasatch County A Delightful Summer Living Area*

Wasatch County is fast becoming the delightful summer home area for Salt Lake City and the larger communities of Utah County.

Within easy commuting distance of the state's major population areas, Wasatch County offers ideal temperatures in winter and summer for healthful living and recreation diversion.

Heber City, county seat, is 52 miles from Salt Lake City and 23 miles from Provo. Both are reached over super highways.

Summer Homes

Expensive summer homes are already being built in the Midway area by those who live in other parts of the state.

There are many reasons for this new move. The invigorating mountain locale offers skiing and winter sports from holiday time into March or April.

Summer months are loaded with activities because of the proximity of the world's only odorless mineral hot springs. Swimming and horseback riding have become major attractions in the area and 15 restaurants offer delightful menu to the resident or visitor.

New Road

With the coming of the new road in Pine Canyon, north of Midway, next year, it will be possible for seekers of mountain scenery to drive from Salt Lake City to Pine Canyon in half an hour. Cool springs, large areas of virgin timber, cool plateaus are all a part of the drive plus an uninhabited view of the expanse of Heber Valley and Deer Creek reservoir.

Dude ranches and a new golf course are in the offing for this growing land of play.

There are modern motel facilities for over 500 guests in Heber. Motel owners have looked ahead to the near future when the new road will bring an overflow crowd to the ski slopes of Alta and Brighton.

Home builders in the county find plenty of native timber and locally processed sandstone to keep their buildings

ture in Wasatch County will find it strategically located. Heber marks the junction of Highways 189 and U.S. 40, opening the vast Uintah Basin and Strawberry Reservoir to easy distance.

Although present mining activities are lulled by the temporary shutdown of the lead, zinc and silver mines, Wasatch County has been a major contributor in the raw materials field of the West.

The average working force of Wasatch County is about 2,000 men. The figure fluctuates with seasonal work.

Lumbering provides good employment during the summer months with several million feet of timber contracted for by Great Lakes Timber Co., Anderson Lumber Co. and Rothe Saw Mills. These contracts are for timber to be cut and processed over the next 10 years.

Good feed, cool water, high altitude and scarcity of flies and parasites are the assets of a paying dairy industry in Wasatch County. Modern milking plants have facilitated getting the A-grade milk to the nearby markets.



costs to a minimum.

Heber provides its own power through Heber Light and Power Co., owners of two hydro-electric plants which furnish the majority of power needed in the valley. Utah Power and Light Co. provides able standby service.

The fish hatchery at Midway produces millions of fish each year for distribution in lush trout-fishing streams and lakes. Hunters and fishermen make constant use of the natural resources in Wasatch County. There is always excitement in the hunt. This year two large bears were among the trophies brought from the mountain during deer hunting season.

Basis Industry

Mining, agriculture and dairying have provided the economic backbone of Heber Valley since the days of the first settlers. Swiss Days in Midway each year recall the early cheesemaking industries which were active in the valley. Heber rodeos have gained statewide attention.

Those investing their fu-

7000